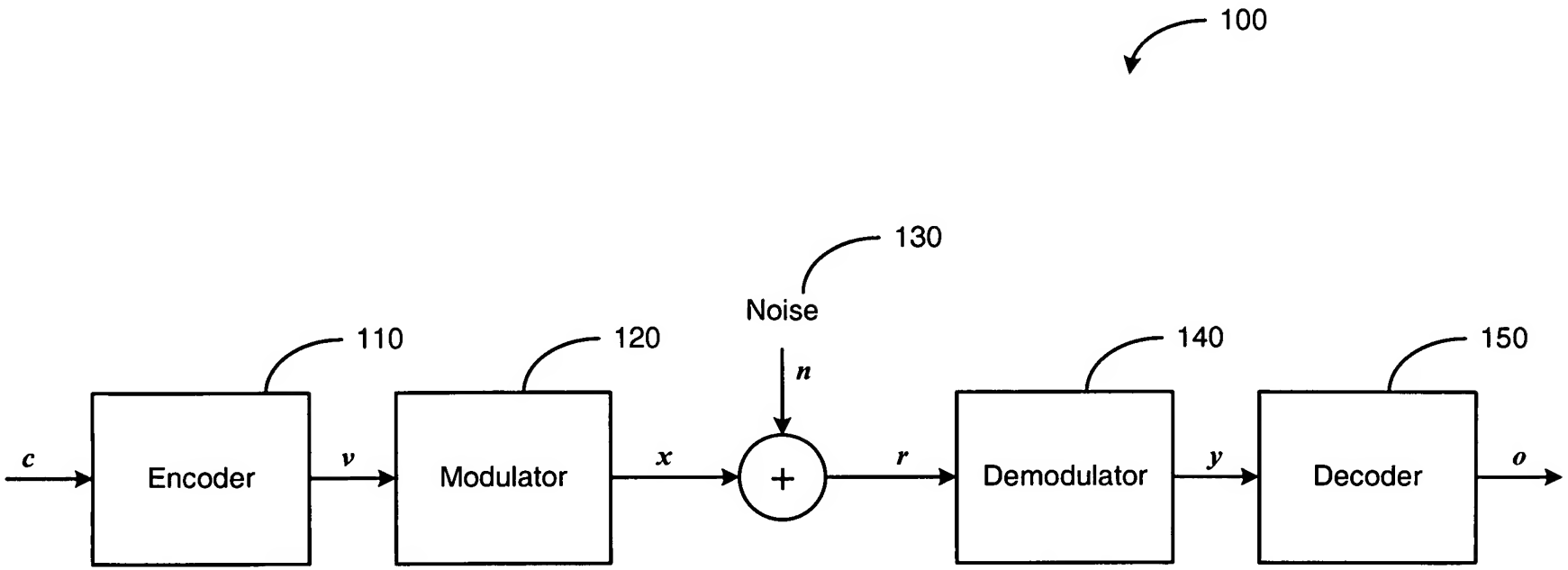

100
130
Noise
110
120
140
150
n
c
Encoder
v
Modulator
x
+
r
Demodulator
y
Decoder
o

Figure 1A

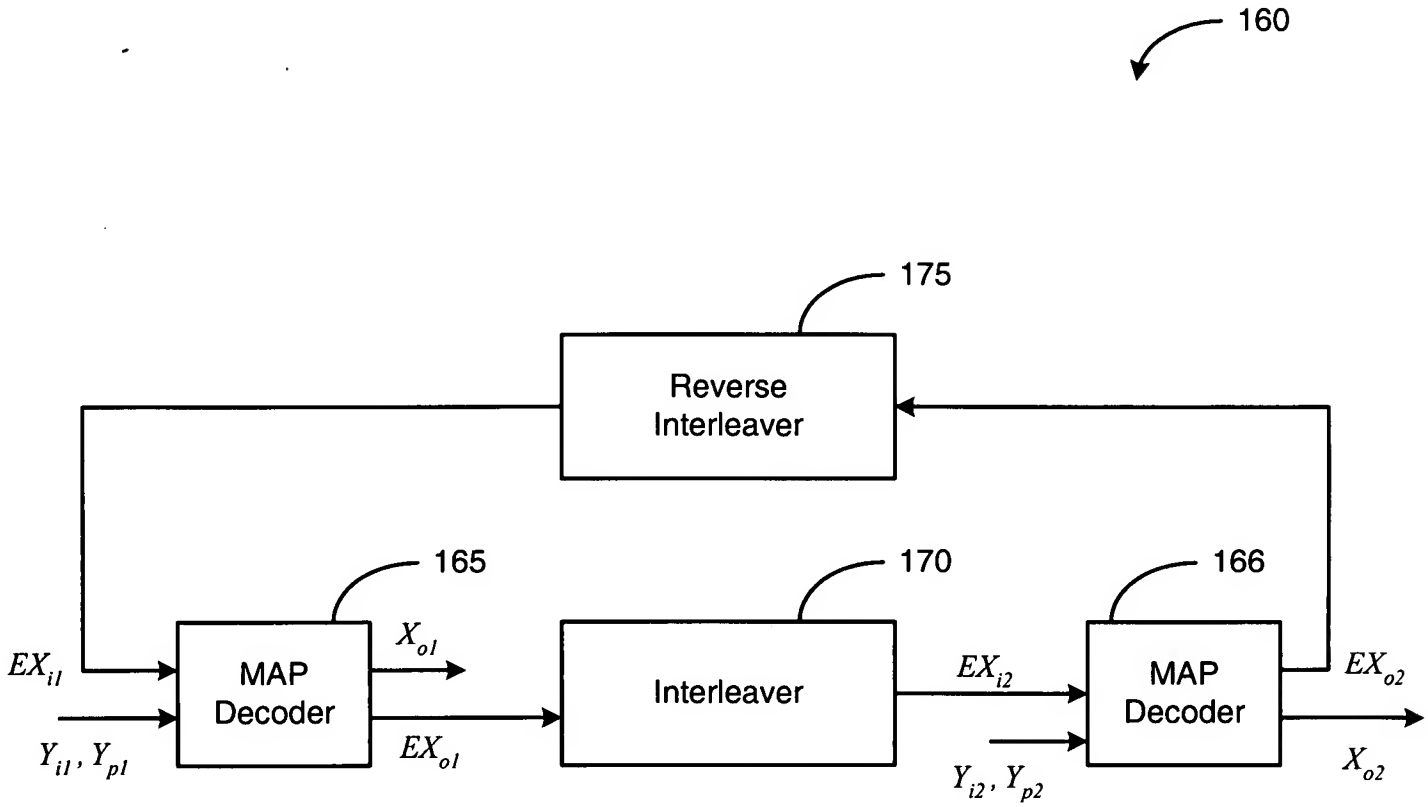

160
175
Reverse
Interleaver
165
170
166
EX_{i1}
MAP
Decoder
X_{o1}
EX_{o1}
Y_{i1}, Y_{p1}
Interleaver
EX_{i2}
Y_{i2}, Y_{p2}
MAP
Decoder
EX_{o2}
X_{o2}

Figure 1B

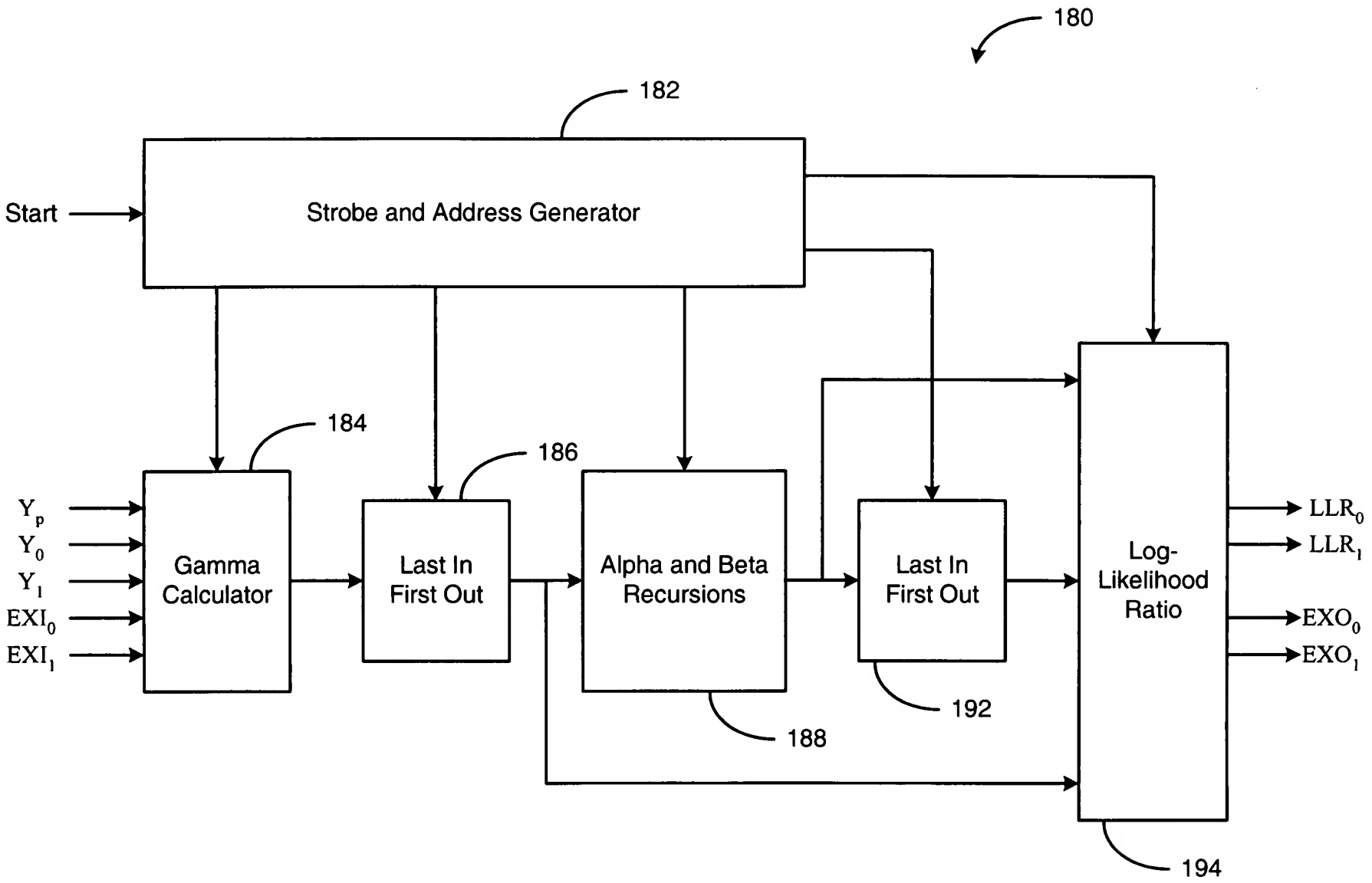

180
182
Start
Strobe and Address Generator
184
186
Y_p
Y_0
Y_1
EXI_0
EXI_1
Gamma Calculator
Last In First Out
Alpha and Beta Recursions
Last In First Out
Log-Likelihood Ratio
LLR_0
LLR_1
EXO_0
EXO_1
188
192
194

Figure 1C

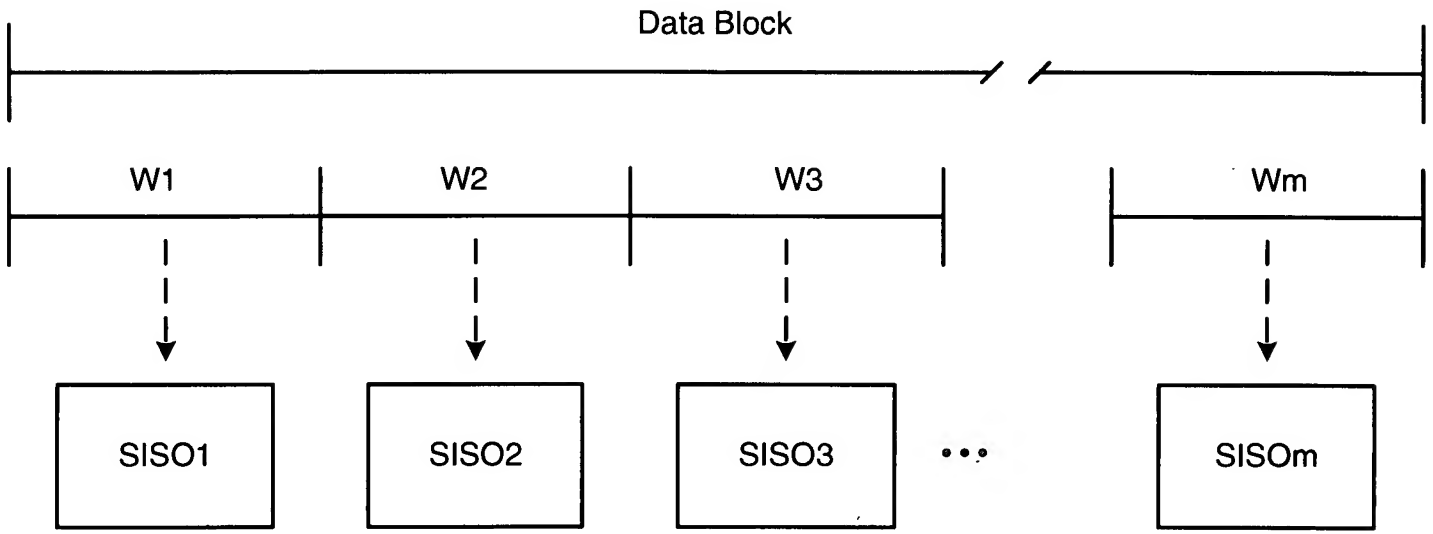


Figure 1D

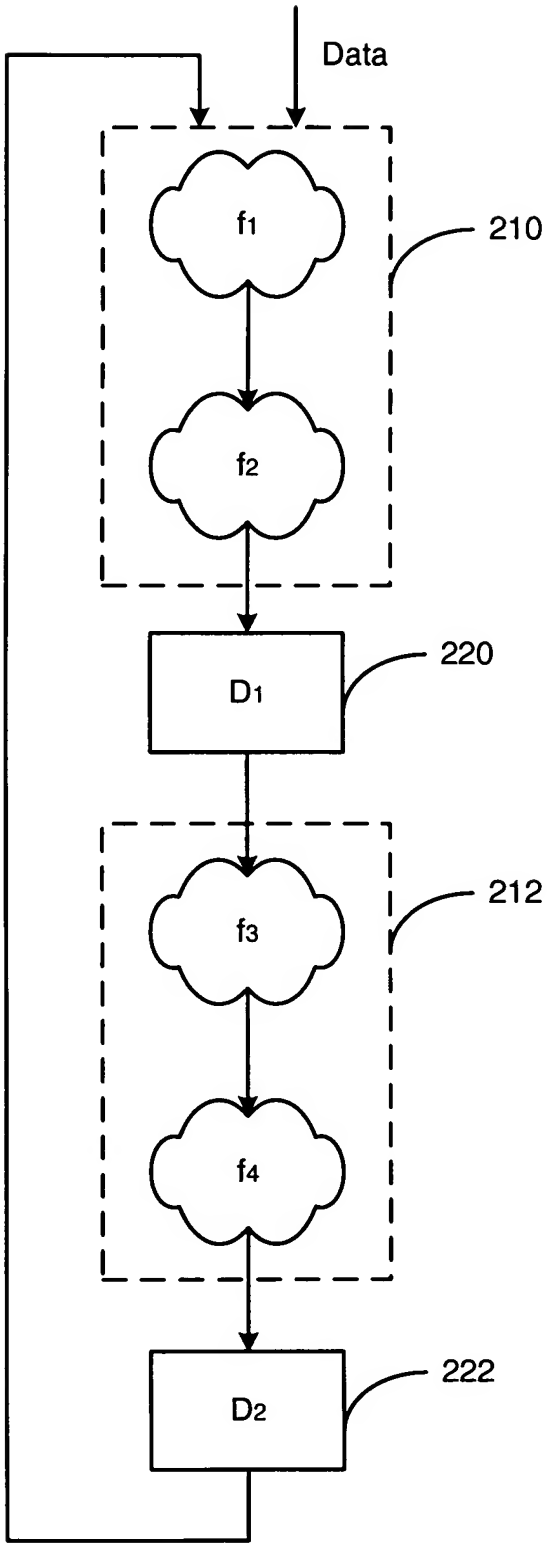


Figure 2

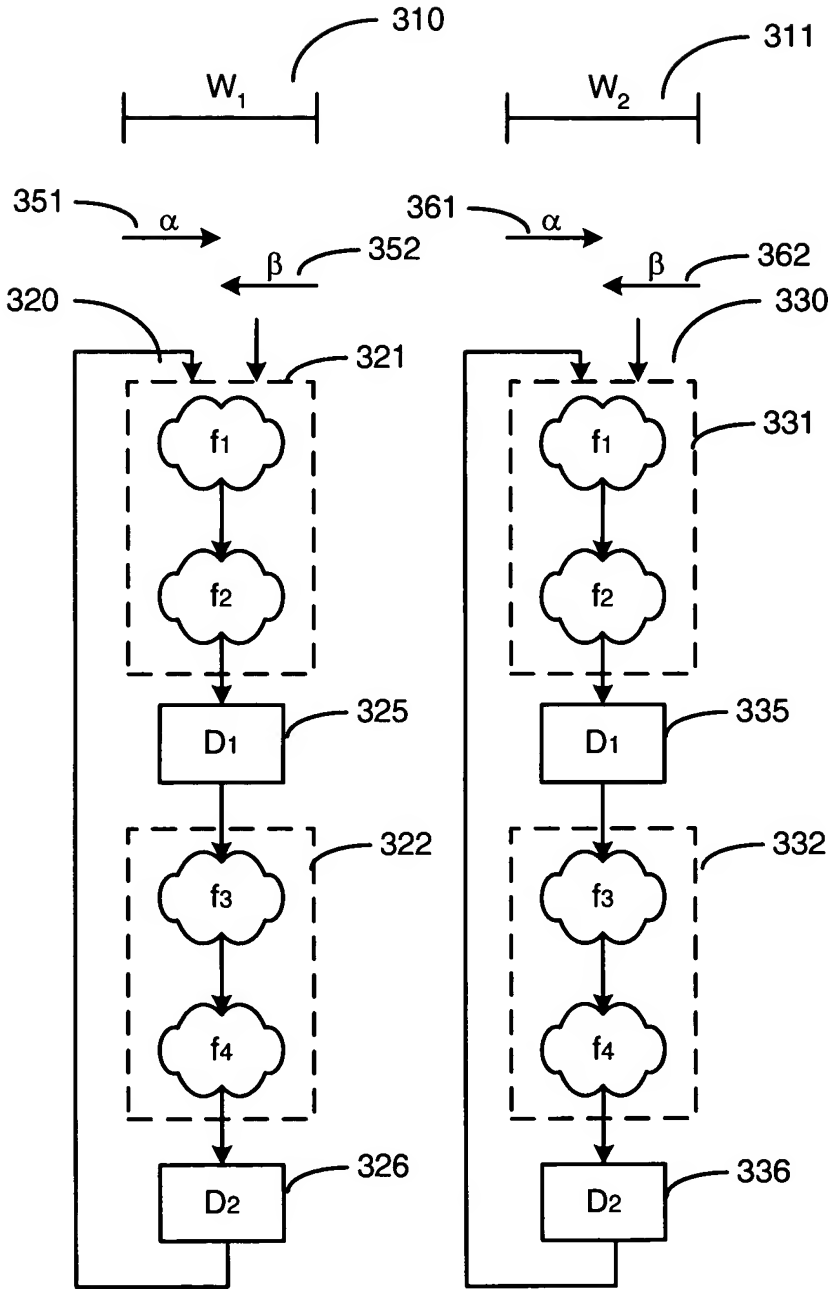

310
311
W1
W2
351
α
361
α
β
352
β
362
320
330
321
f1
f2
331
D1
325
335
322
f3
f4
332
D2
326
336

Figure 3

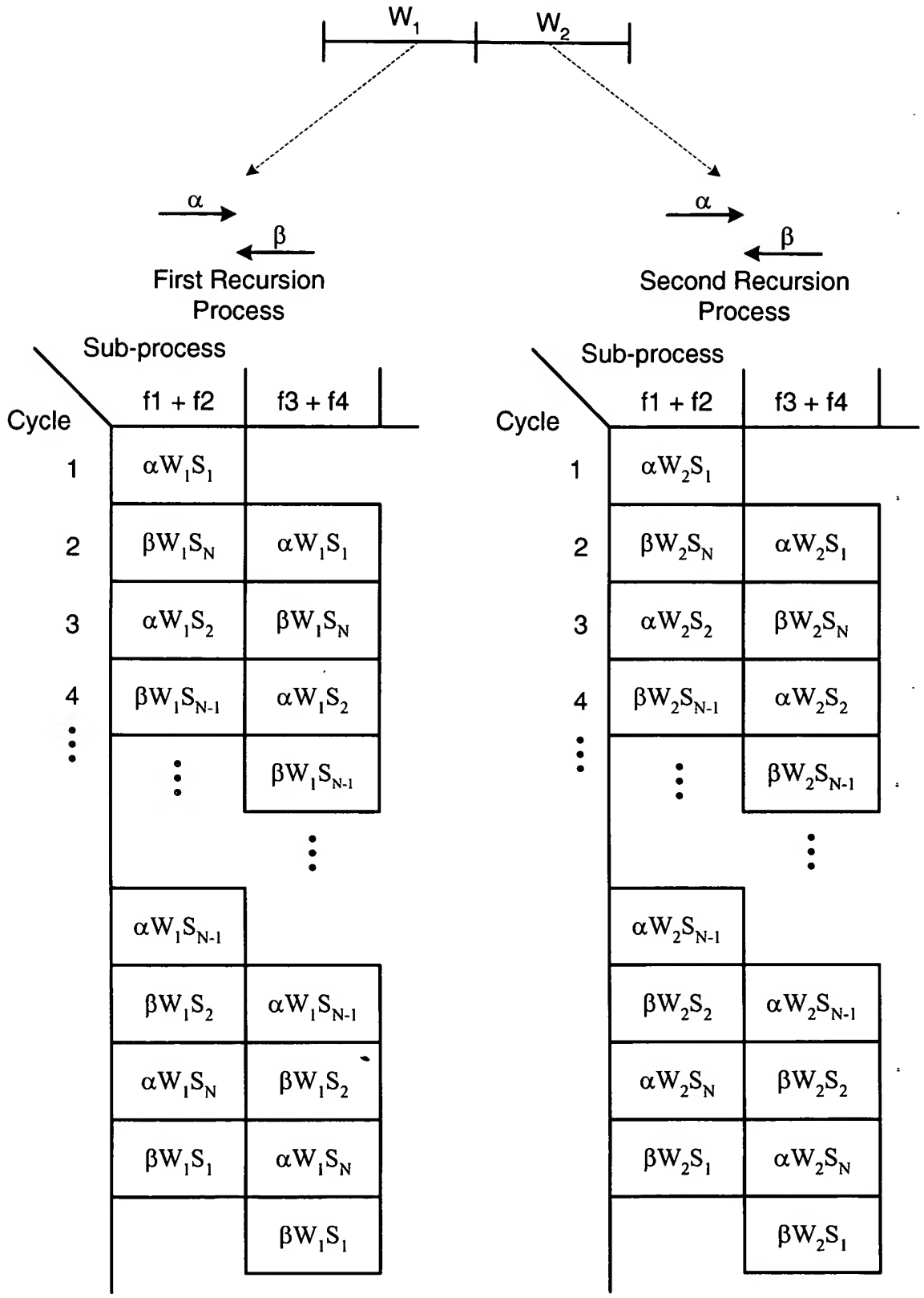

W1
W2
α
β
First Recursion Process
Second Recursion Process
Sub-process
Cycle
f1 + f2
f3 + f4
1
2
3
4
αW1S1
βW1SN
αW1S2
βW1SN-1
αW1S1
βW1SN
αW1S2
βW1SN-1
αW1SN-1
βW1S2
αW1SN
βW1S1
αW1SN-1
βW1S2
αW1SN
βW1S1
αW2S1
βW2SN
αW2S2
βW2SN-1
αW2S1
βW2SN
αW2S2
βW2SN-1
αW2SN-1
βW2S2
αW2SN
βW2S1
αW2SN-1
βW2S2
αW2SN
βW2S1

Figure 4

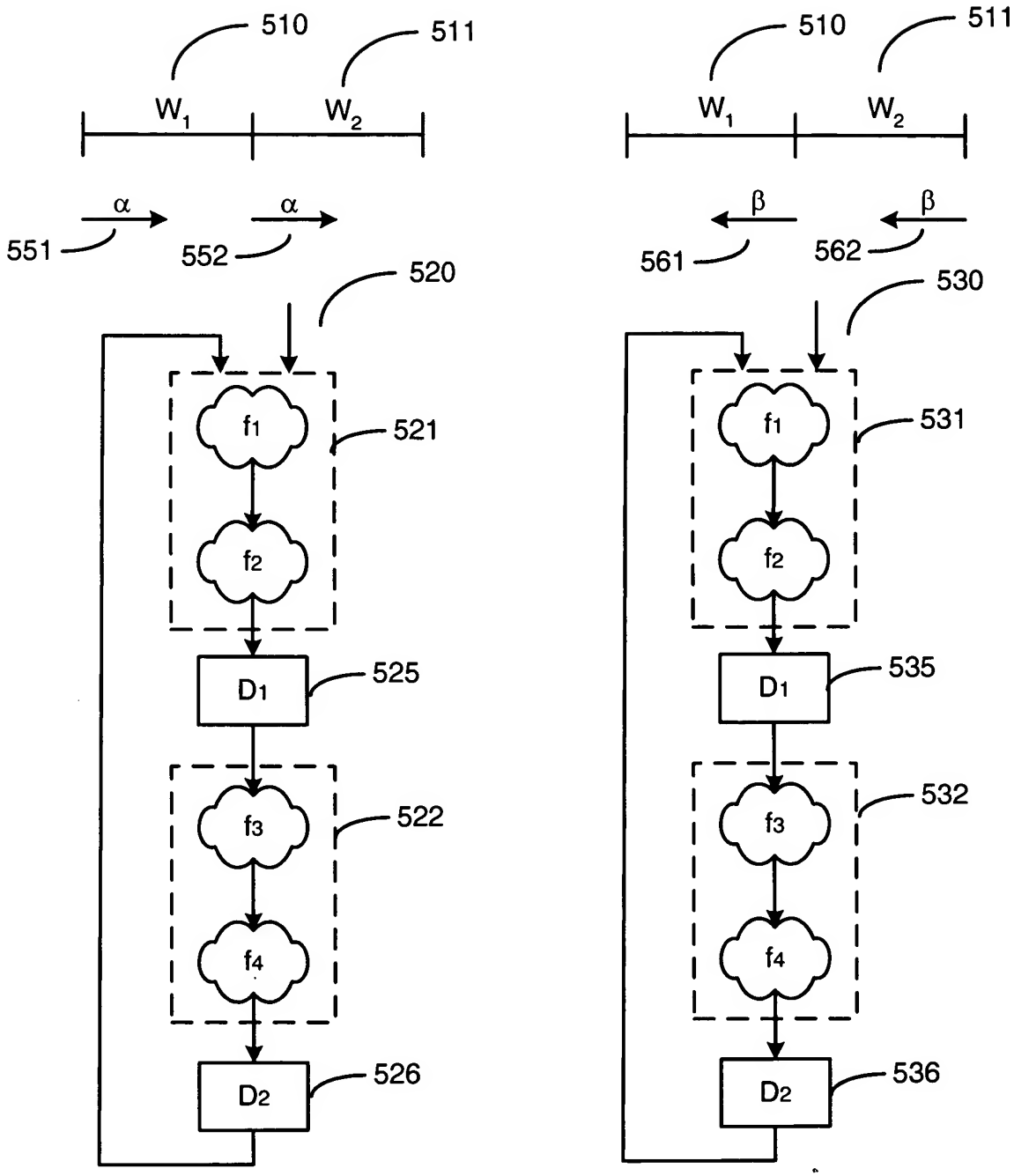

510
511
W1
W2
α
α
551
552
520
f1
521
f2
D1
525
f3
522
f4
D2
526
510
511
W1
W2
β
β
561
562
530
f1
531
f2
D1
535
f3
532
f4
D2
536

Figure 5

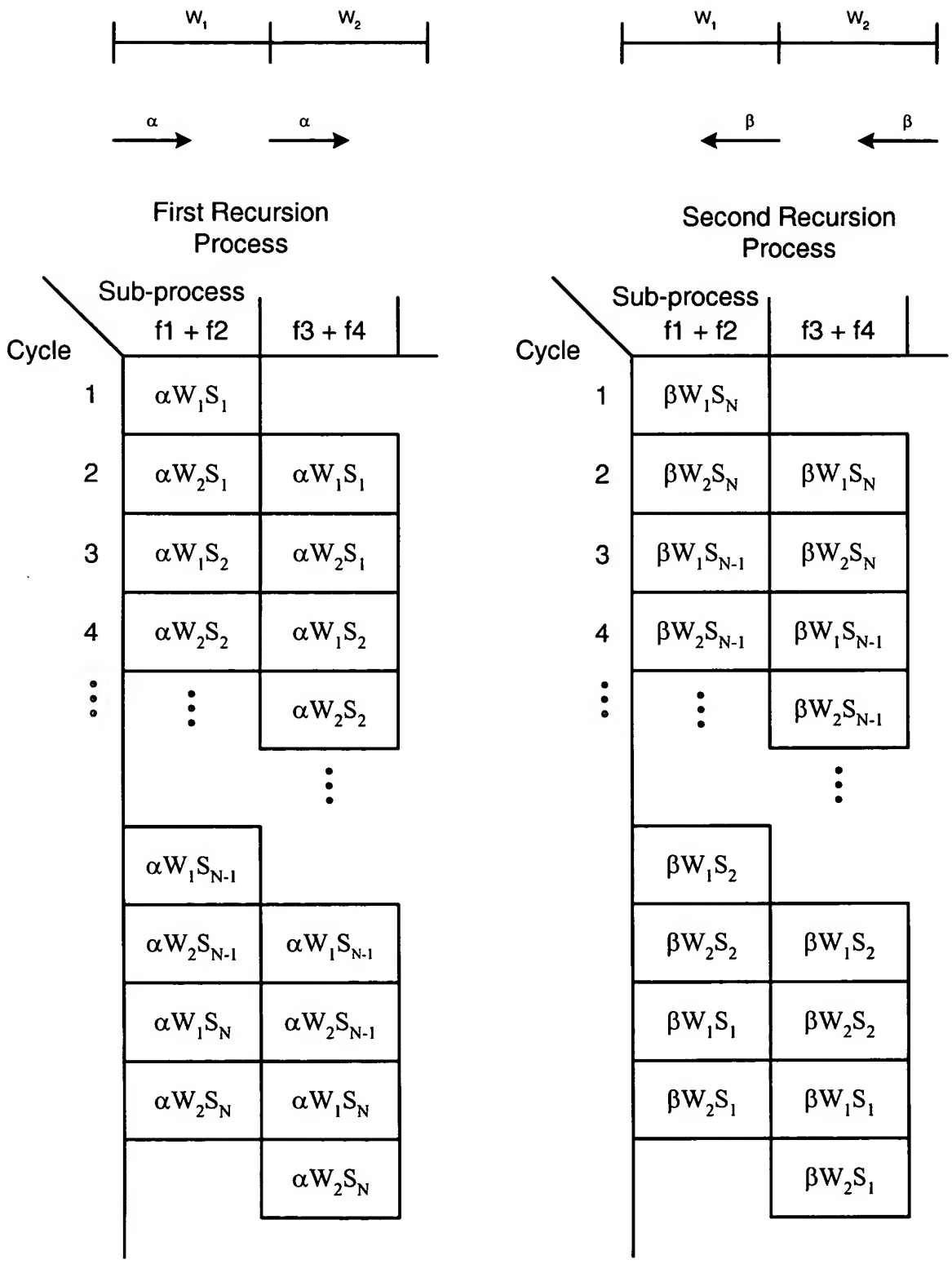

W1
W2
α
α
First Recursion Process
Sub-process
f1 + f2
f3 + f4
Cycle
1
2
3
4
αW1S1
αW2S1
αW1S2
αW2S2
αW1S1
αW2S2
αW1SN-1
αW2SN-1
αW1SN
αW2SN
αW1SN-1
αW2SN
W1
W2
β
β
Second Recursion Process
Sub-process
f1 + f2
f3 + f4
Cycle
1
2
3
4
βW1SN
βW2SN
βW1SN-1
βW2SN-1
βW1SN
βW2SN-1
βW1S2
βW2S2
βW1S1
βW2S1
βW1S2
βW2S2
βW1S1
βW2S1

Figure 6

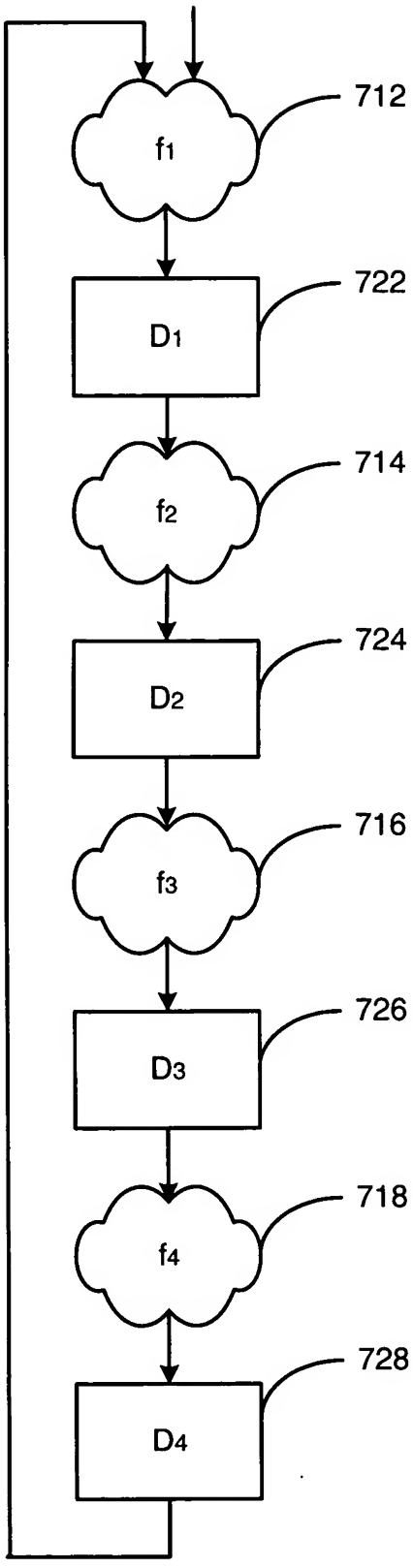


Figure 7

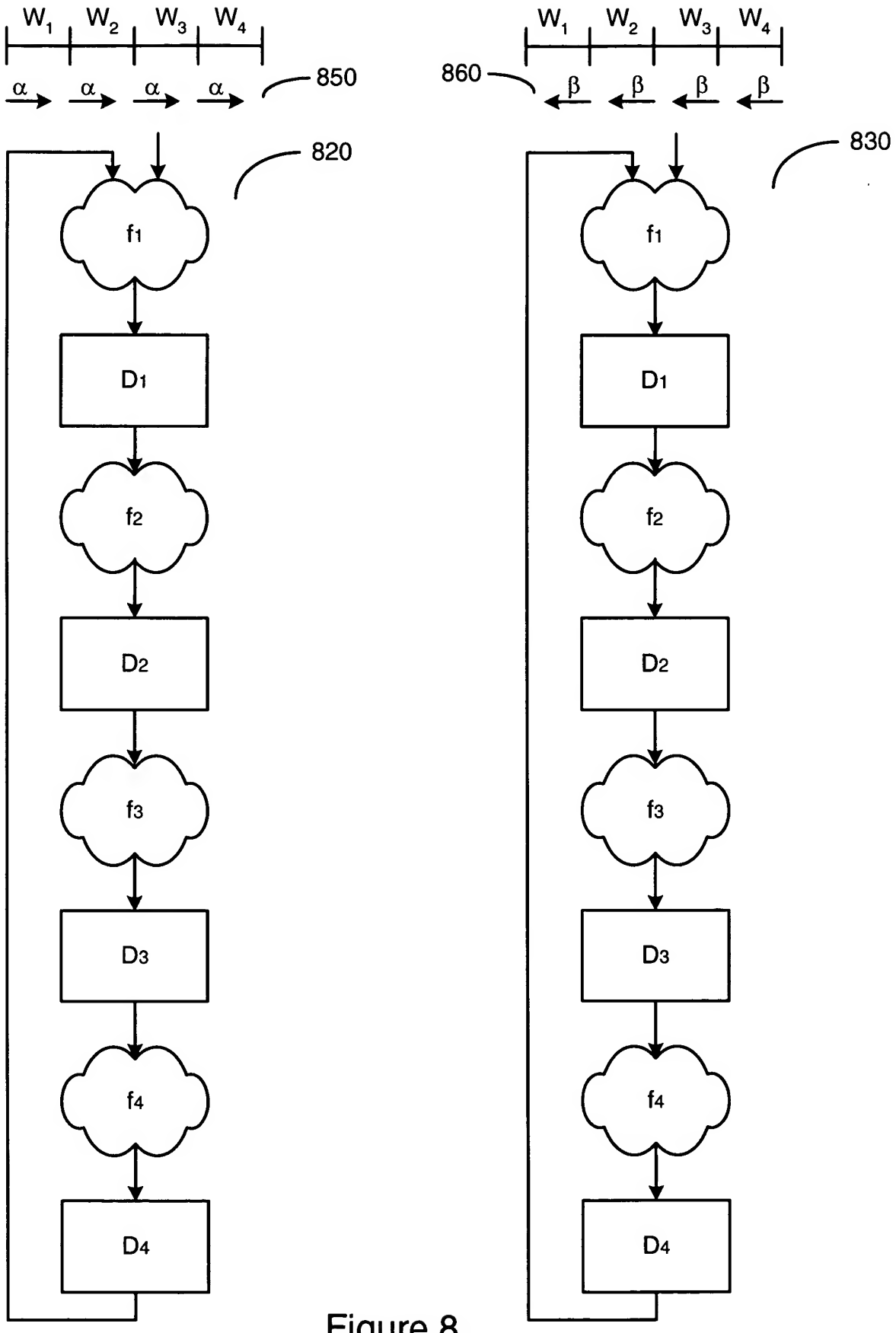

W1
W2
W3
W4
α
α
α
α
850
820
f1
D1
f2
D2
f3
D3
f4
D4
W1
W2
W3
W4
860
β
β
β
β
830
f1
D1
f2
D2
f3
D3
f4
D4

Figure 8

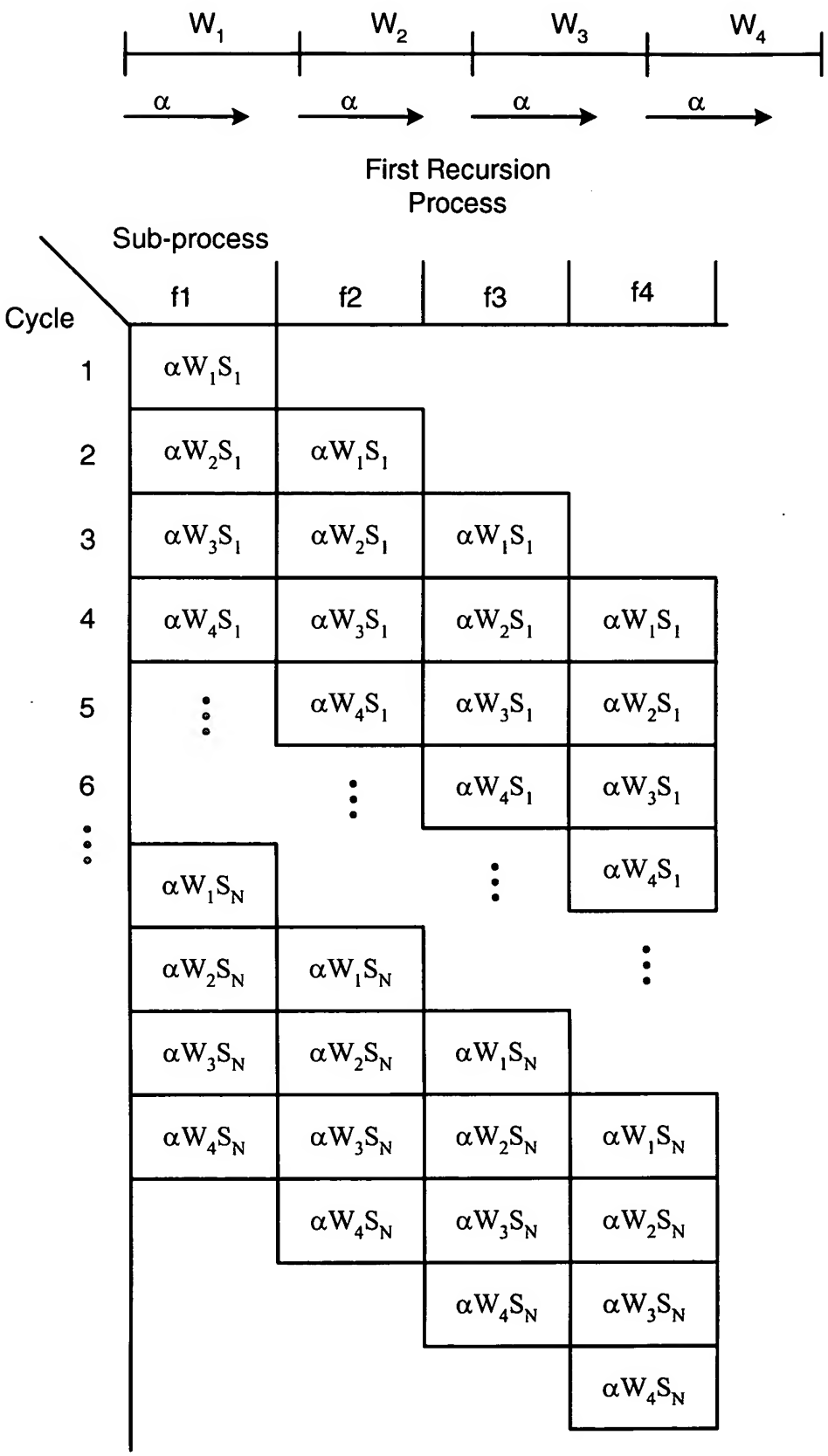

W1
W2
W3
W4
α
α
α
α
First Recursion Process
Sub-process
Cycle
f1
f2
f3
f4
1
2
3
4
5
6
αW1S1
αW2S1
αW1S1
αW3S1
αW2S1
αW1S1
αW4S1
αW3S1
αW2S1
αW1S1
αW4S1
αW3S1
αW2S1
αW4S1
αW3S1
αW1SN
αW4S1
αW2SN
αW1SN
αW3SN
αW2SN
αW1SN
αW4SN
αW3SN
αW2SN
αW1SN
αW4SN
αW3SN
αW2SN
αW4SN
αW3SN
αW4SN

Figure 9A

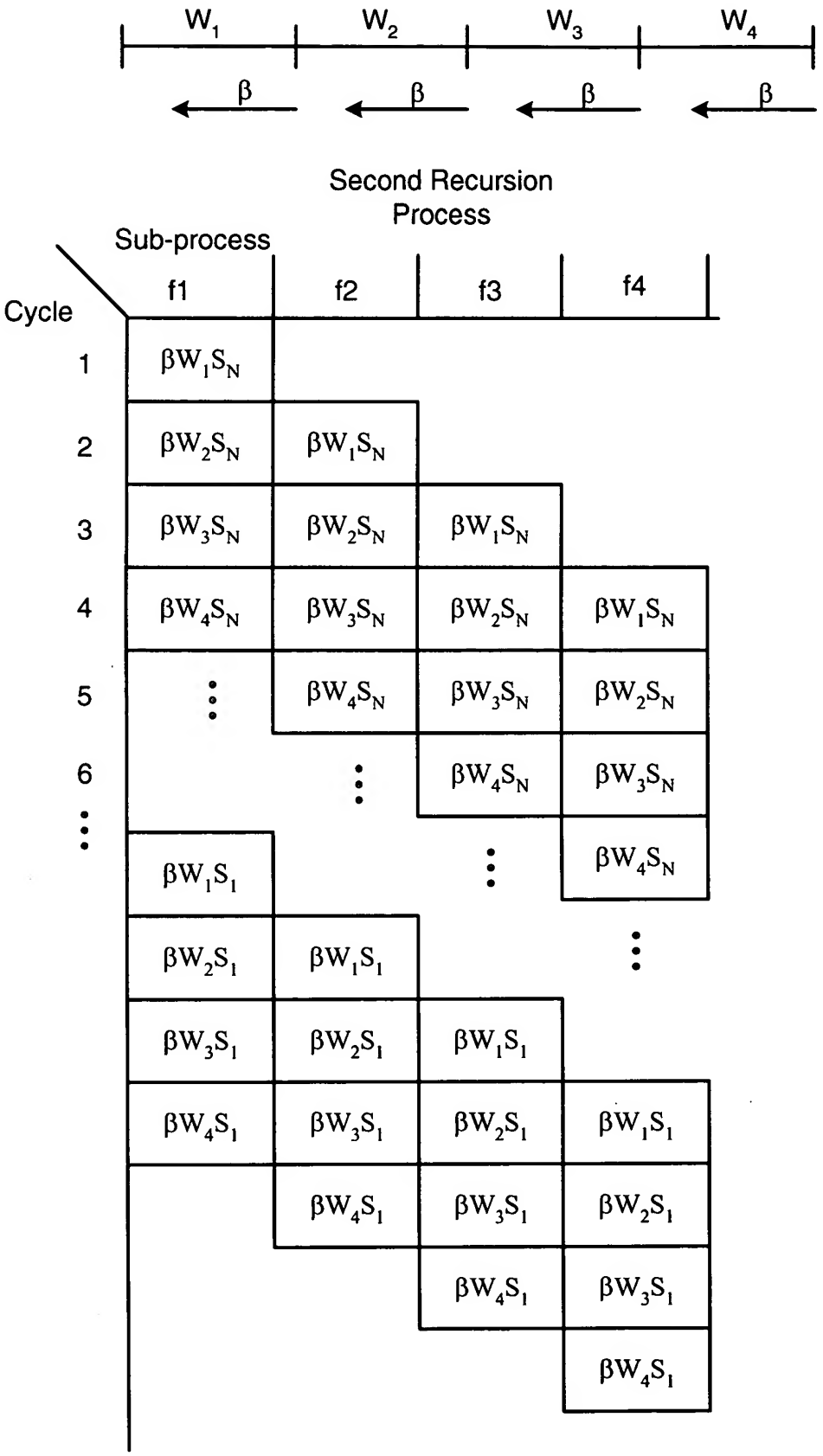

W1
W2
W3
W4
β
β
β
β
Second Recursion Process
Sub-process
Cycle
f1
f2
f3
f4
1
2
3
4
5
6
βW1SN
βW2SN
βW1SN
βW3SN
βW2SN
βW1SN
βW4SN
βW3SN
βW2SN
βW1SN
βW4SN
βW3SN
βW2SN
βW4SN
βW3SN
βW4SN
βW1S1
βW2S1
βW1S1
βW3S1
βW2S1
βW1S1
βW4S1
βW3S1
βW2S1
βW1S1
βW4S1
βW3S1
βW2S1
βW4S1
βW3S1
βW4S1

Figure 9B

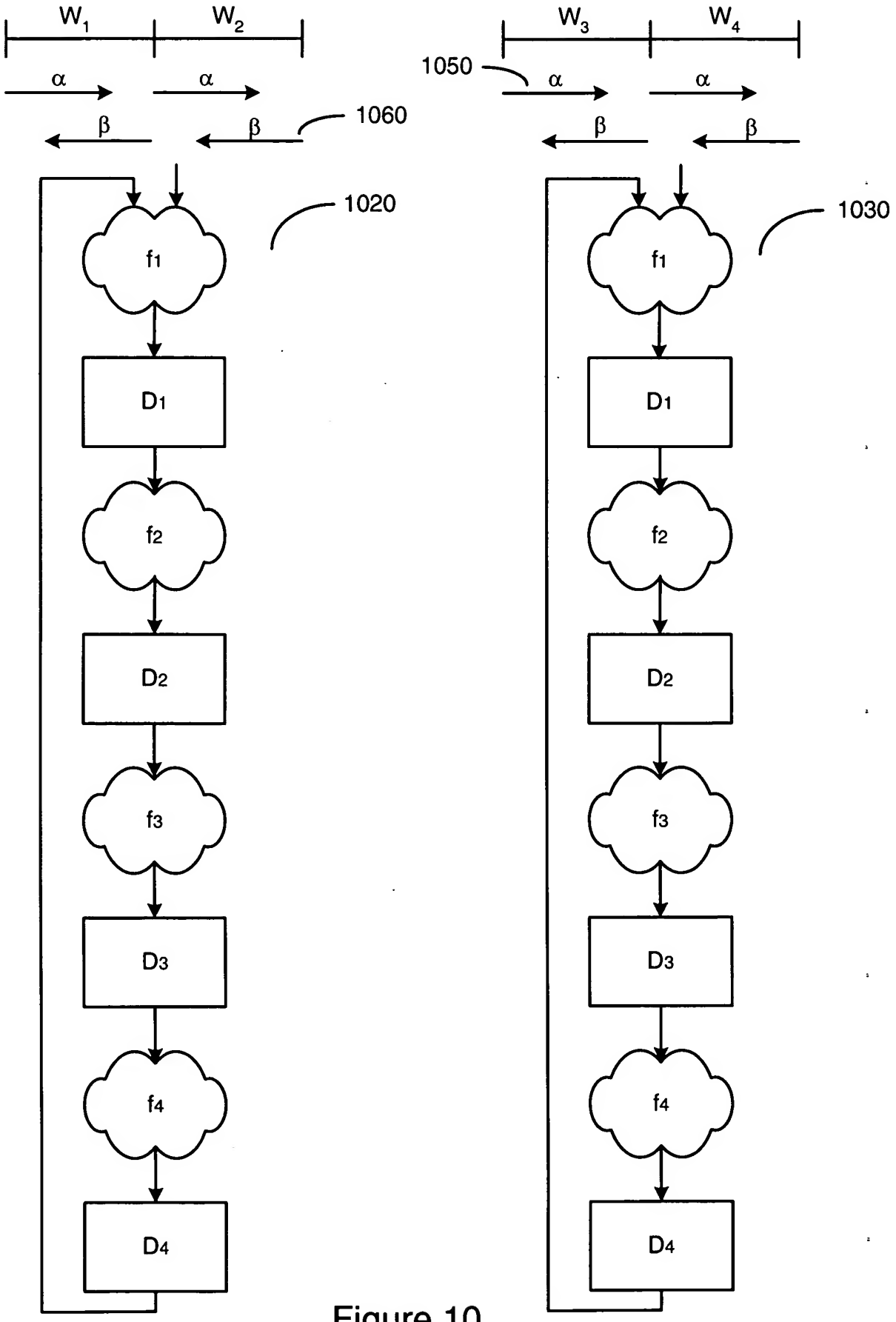

W1
W2
α
α
β
β
1060
1020
f1
D1
f2
D2
f3
D3
f4
D4
W3
W4
1050
α
α
β
β
1030
f1
D1
f2
D2
f3
D3
f4
D4

Figure 10

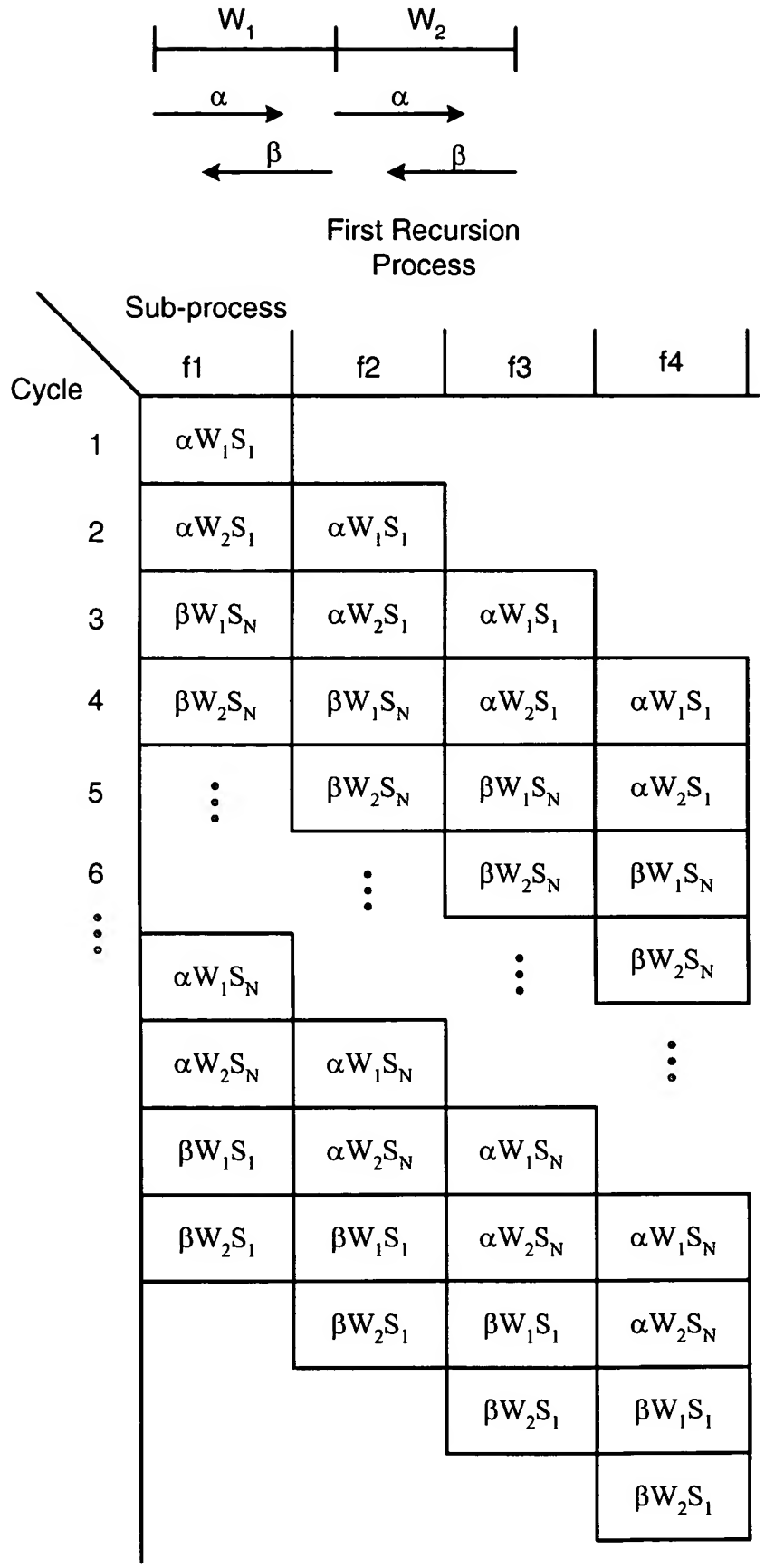
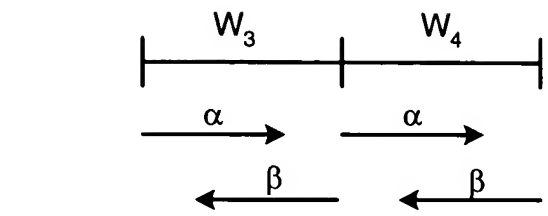

W1
W2
α
α
β
β
First Recursion Process
Sub-process
Cycle
f1
f2
f3
f4
1
2
3
4
5
6
αW1S1
αW2S1
αW1S1
βW1SN
αW2S1
αW1S1
βW2SN
βW1SN
αW2S1
αW1S1
βW2SN
βW1SN
αW2S1
βW2SN
βW1SN
αW1SN
βW2SN
αW2SN
αW1SN
βW1S1
αW2SN
αW1SN
βW2S1
βW1S1
αW2SN
αW1SN
βW2S1
βW1S1
αW2SN
βW2S1
βW1S1
βW2S1

Figure 11A



Second Recursion Process

Cycle	Sub-process f1	f2	f3	f4
1	$\alpha W_3 S_1$			
2	$\alpha W_4 S_1$	$\alpha W_3 S_1$		
3	$\beta W_3 S_N$	$\alpha W_4 S_1$	$\alpha W_3 S_1$	
4	$\beta W_4 S_N$	$\beta W_3 S_N$	$\alpha W_4 S_1$	$\alpha W_3 S_1$
5	⋮	$\beta W_4 S_N$	$\beta W_3 S_N$	$\alpha W_4 S_1$
6		⋮	$\beta W_4 S_N$	$\beta W_3 S_N$
⋮	$\alpha W_3 S_N$		⋮	$\beta W_4 S_N$
	$\alpha W_4 S_N$	$\alpha W_3 S_N$		⋮
	$\beta W_3 S_1$	$\alpha W_4 S_N$	$\alpha W_3 S_N$	
	$\beta W_4 S_1$	$\beta W_3 S_1$	$\alpha W_4 S_N$	$\alpha W_3 S_N$
		$\beta W_4 S_1$	$\beta W_3 S_1$	$\alpha W_4 S_N$
			$\beta W_4 S_1$	$\beta W_3 S_1$
				$\beta W_4 S_1$

Figure 11B

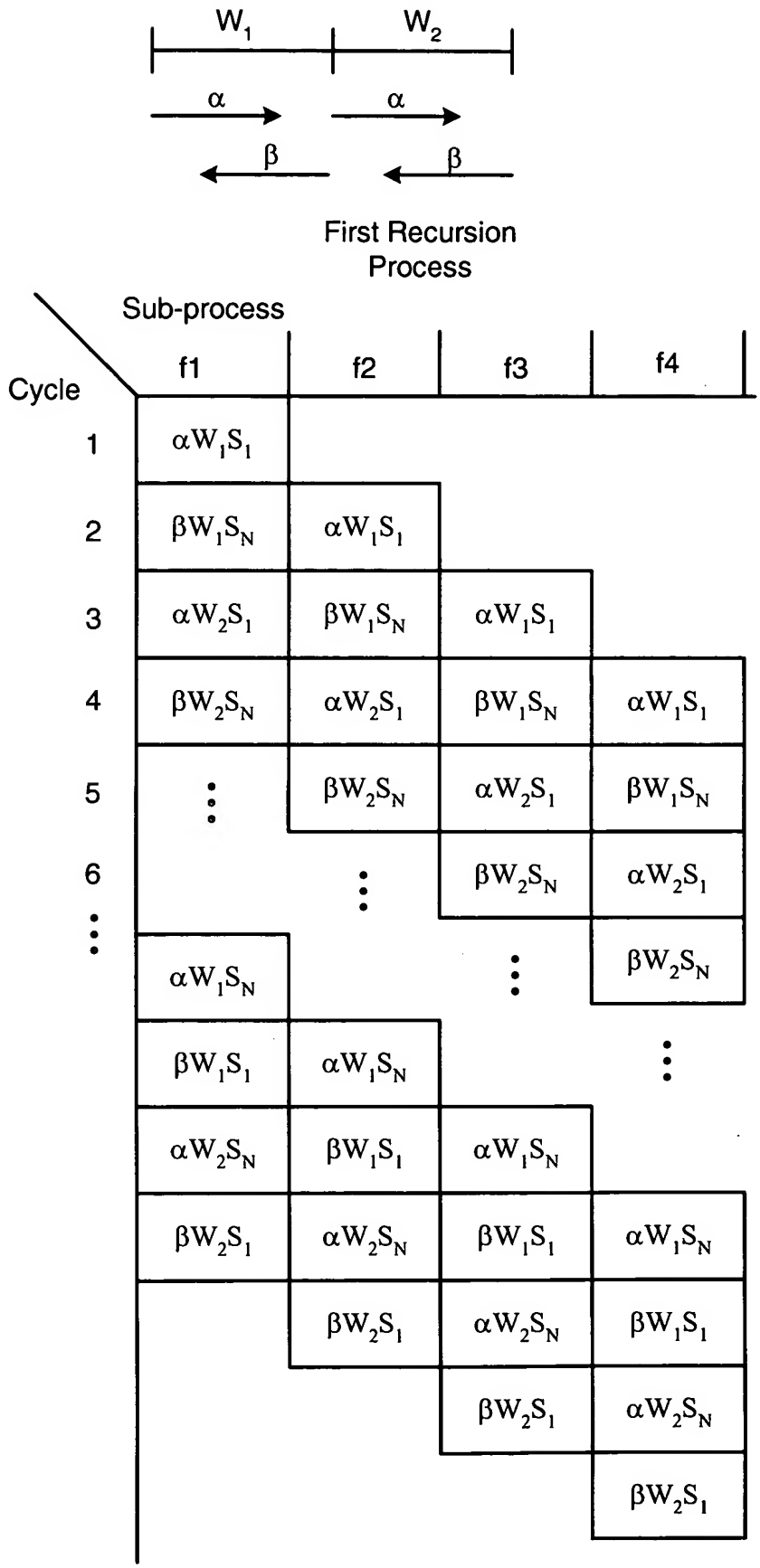
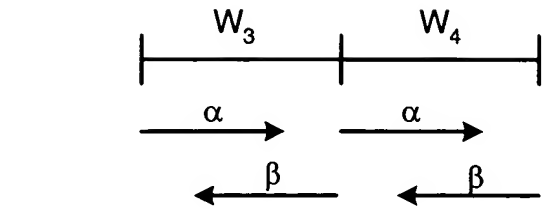

W1
W2
α
α
β
β
First Recursion Process
Sub-process
Cycle
f1
f2
f3
f4
1
2
3
4
5
6
αW1S1
βW1SN
αW2S1
βW2SN
αW1SN
βW1S1
αW2SN
βW2S1
αW1S1
βW1SN
αW2S1
βW2SN
αW1SN
βW1S1
αW2SN
βW2S1
αW1S1
βW1SN
αW2S1
βW2SN
αW1SN
βW1S1
αW2SN
βW2S1

Figure 11C



Second Recursion Process

Cycle	Sub-process f1	f2	f3	f4
1	$\alpha W_3 S_1$			
2	$\beta W_3 S_N$	$\alpha W_3 S_1$		
3	$\alpha W_4 S_1$	$\beta W_3 S_N$	$\alpha W_3 S_1$	
4	$\beta W_4 S_N$	$\alpha W_4 S_1$	$\beta W_3 S_N$	$\alpha W_3 S_1$
5	⋮	$\beta W_4 S_N$	$\alpha W_4 S_1$	$\beta W_3 S_N$
6		⋮	$\beta W_4 S_N$	$\alpha W_4 S_1$
⋮	$\alpha W_3 S_N$		⋮	$\beta W_4 S_N$
	$\beta W_3 S_1$	$\alpha W_3 S_N$		⋮
	$\alpha W_4 S_N$	$\beta W_3 S_1$	$\alpha W_3 S_N$	
	$\beta W_4 S_1$	$\alpha W_4 S_N$	$\beta W_3 S_1$	$\alpha W_3 S_N$
		$\beta W_4 S_1$	$\alpha W_4 S_N$	$\beta W_3 S_1$
			$\beta W_4 S_1$	$\alpha W_4 S_N$
				$\beta W_4 S_1$

Figure 11D